

```

> restart;
phi:=proc(x,L)
    if x>L then
        0
    else
        if x>=0 then 1-x else
            phi(-x,L)
        end if;
    end if;
end proc;

phiLocal:=proc(i,x,h,L)
    phi(x/h-(i-1),L)
end proc;

yapprox:=proc(x,c,h,n,L)
    local i;
    add(c[i]*phiLocal(i,x,h,L),i=1..n)
end proc;

L:=1; nPoints:=100; nElements:=nPoints-1;
q:=4; f:=4;
nShapeFunctions:=nPoints;
h:=evalf(L/nElements);
#plot(['phiLocal(i,x,h,L)' $i=1..nPoints],x=0..L);
with(LinearAlgebra):

makeMatrix:=proc(q,h,f,nPoints)
    local A,i,j;
    A:=Matrix(nPoints);
    for i from 1 to nPoints do
        for j from 1 to nPoints do
            if i=j then
                A[i,j]:=2+2/3 * q*h^2;
            else
                if j=i-1 or j=i+1 then
                    A[i,j]:= -1+1/6 *q *h^2;
                end if;
            end if;
        end do;
    end do;
end do;
A

```

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end proc:
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```
A:=makeMatrix(q,h,f,nPoints):
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```
b:=Vector(nPoints):
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```
b[1..-1]:=h^2*f:
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```
c:=LinearSolve(A,b):
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```
with(plots):
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```
listplot(['yapprox(i*h,c,h,nPoints,L)' $i=0..nPoints-1]);
```

```
 $\phi := \text{proc}(x, L) \text{ if } L < x \text{ then } 0 \text{ else if } 0 \leq x \text{ then } 1 - x \text{ else } \phi(-x, L) \text{ end if end if end proc}$ 
```

```
phiLocal := proc(i, x, h, L) phi(x/h - i + 1, L) end proc
```

```
yapprox := proc(x, c, h, n, L) local i; add(c[i]*phiLocal(i, x, h, L), i=1..n) end proc
```

```
L := 1
```

```
nPoints := 100
```

```
nElements := 99
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```
q := 4
```

```
f := 4
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```
nShapeFunctions := 100
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```
h := 0.01010101010
```

